

AMENDMENTS TO THE DRAWINGS

The attached sheet(s) of drawings includes changes.

Appendix A

Attachment: Replacement sheets for FIGs. 4, 5D, 5E, 5F, 5G, 5H, 6, 7E, 7F,
7G, 7H, 8, 9F, 9G, and 9H; and
Annotated sheets showing changes in red ink.

REMARKS

Claims 1, 4-6, 11, 13, 14, 17, 18, 20, 25, 30, 35, 35, 40, 46-50, and 235 are amended. Claims 51-234 and 236-240 were previously withdrawn from consideration and are now cancelled, without prejudice to their underlying subject matter. Claims 15, 16, 19, 21, 26-29, 38, 39, 41, and 42 are also cancelled without prejudice to their underlying subject matter. Claims 1-14, 17, 18, 20, 22-25, 30-37, 40, 43-50, and 235 are pending. The drawings are amended and replacement sheets are attached at Appendix A (changes are shown in red ink in the mark-up versions); no new matter is added. A Request for Continued Examination is filed herewith.

The drawings stand objected to under 37 C.F.R. § 1.83(a). The objection is respectfully traversed. The amendment to the claims and the replacement of FIGs. 4, 5D, 5E, 5F, 5G, 5H, 6, 7E, 7F, 7G, 7H, 8, 9F, 9G, and 9H overcomes the objection. The objection is respectfully requested to be withdrawn.

Claims 1-30 stand rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter not described in the specification in such a way as to reasonably convey to one skilled in the art that the inventor had possession of the claimed invention as of the application's filing date. Applicant respectfully traverses this rejection.

Claim 1 is rejected under Section 112, first paragraph, as reciting (amended) "a doped region in said substrate and at said surface thereof, said doped region being of a first conductivity type and having a graded profile, wherein said doped region has a higher dopant concentration near the surface of the substrate," which is alleged not to be disclosed in the application's specification. This is incorrect and this subject matter is adequately disclosed.

The specification at, inter alia, paragraphs 86 through 94, and specifically paragraph 90, instructs that region 104a, for example as shown in FIG. 4, is formed so that it reaches into the substrate (102) from its surface toward an underlying charge accumulation region (135). The specification discloses that region 104b, a second implant region, is formed partially overlapping with region 104a, making that overlapped part of region 104a, which is near the substrate surface, even more concentrated with dopant than other parts of region 104a deeper within the substrate.

For example, paragraph 90 of the specification states, “[i]t should be appreciated that portions of region 104a is further doped with the dopant ions used to form region 104b. As a result, the top surface of region 104a has a higher dopant concentration than the 104a region found deeper within substrate 102.” This structure is illustrated by FIGs. 4 and 5E-5H, and in similar layout in FIGs. 8, 9G, and 9H. Therefore, the Office Action (page 5) assertion that the recited “a doped region in said substrate and at said surface thereof” having “a graded profile, wherein said doped region has a higher dopant concentration near the surface of the substrate” is not disclosed in the specification is incorrect and the rejection of claims 1-29 under 35 U.S.C. § 112, first paragraph, is respectfully requested to be withdrawn.

Claim 30, as amended, recites in part, “a second region of said substrate, said second region being adjacent to said first region, said second region having a dopant concentration substantially the same as said substrate dopant concentration.” This amendment clarifies how the second region is intended to be undoped with respect to the photoconversion device. Per this amendment, the rejection of claim 30 under 35 U.S.C. § 112, first paragraph, is respectfully requested to be withdrawn.

Claims 30-37, 40-44, and 46-50 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent Application Publication 2004/0173799 ("Patrick"). Applicant respectfully traverses this rejection.

Claim 30, as amended, defines a photoconversion device and recites "a substrate having a surface and a substrate dopant concentration" and "a first region of said substrate, said first region being doped to a first conductivity type and at least partially located at the surface of the substrate" and "a second region of said substrate, said second region being adjacent to said first region, said second region having a dopant concentration substantially the same as said substrate dopant concentration" and "a third region of said substrate, said third region being doped to a second conductivity type, located substantially beneath said first region with respect to said substrate surface, separated from said first region by said second region, and being configured to collect photogenerated charge." Such a device is not disclosed by Patrick.

The CMOS imager disclosed by Patrick does not include "a third region of said substrate, said third region being doped to a second conductivity type, located substantially beneath said first region with respect to said substrate surface, separated from said first region by said second region, and being configured to collect photogenerated charge," as recited by claim 30. The CMOS imager of Patrick does have a charge accumulating region (226) of a second conductivity type (n), however it is not located substantially beneath a first region (indicated to be 270 in the Office Action) of a first conductivity type (p) with respect to the substrate (110) surface.

Also, the charge accumulation region of Patrick is not separated from the first region (270 in Office Action) by the region "280;" a region which the Office Action defines, but nonetheless does not separate Patrick's region 226 from anything. The

positioning of regions 270, 226, and "280" of Patrick is not the same as the recited structure of the first, second and third regions of claim 30. For these reasons, independent claim 30 is not anticipated by Patrick and the rejection of this independent claim and claims 31-37, 40-44, and 46-50 under 35 U.S.C. § 102(e) is respectfully requested to be withdrawn.

Claims 30-34, 40-43, 45, 46, 49, 50, and 235 stand rejected under 35 U.S.C. § 102(b) by U.S. Patent Application Publication 2002/0047115 ("Kawakami et al."). Applicant respectfully traverses this rejection.

Independent claim 30, as amended, has been set forth above in relation to the discussion of its patentability over the Patrick reference. Kawakami et al. does not anticipate the claim.

As with the discussion of claim 30 above, Kawakami et al. fails to disclose "a third region of said substrate, said third region being doped to a second conductivity type, located substantially beneath said first region with respect to said substrate surface, separated from said first region by said second region, and being configured to collect photogenerated charge." It is clear from a review of FIGs. 56D, 58D, and 58E, cited in the Office Action as particularly representative of Kawakami et al.'s disclosure of the claimed device, that no structure similar to that claimed is disclosed by the reference. Kawakami et al. fails to disclose that its representative third region (i.e., 333) is separated in any way from its representative first region (i.e., 304) by its representative second region (i.e., 305).

Because of its lack of disclosure, Kawakami et al. does not anticipate independent claim 30 or dependent claims 31-34, 40-43, 45, 46, 49, 50 and the rejection of these claims is respectfully requested to be withdrawn.

Claim 235, as amended, defines a photoconversion device and recites “a substrate having a surface and a substrate dopant concentration” and “a first region of said substrate doped to a first conductivity type and located at and below the surface of the substrate, said region having a dopant gradient profile wherein said dopant is in higher concentrations nearer said surface of said substrate relative to portions of said first region deeper within said substrate” and “a second region of said substrate doped to a second conductivity type and located substantially beneath said first doped region relative to said surface, said second region being configured with said first region for generating charge from light exposure and collecting photogenerated charges” and “a third region of said substrate, said third region having a dopant concentration substantially the same as said substrate dopant concentration and separating said first and second regions from each other.”

Kawakami et al. fails to disclose “a first region of said substrate doped to a first conductivity type and located at and below the surface of the substrate, said region having a dopant gradient profile wherein said dopant is in higher concentrations nearer said surface of said substrate relative to portions of said first region deeper within said substrate,” as recited by claim 235. The Office Action indicates that regions 304/305 or 104/105 of Kawakami et al. are a disclosure of a single region having a dopant gradient profile. These regions of Kawakami et al. do not form a dopant gradient profile where “said dopant is in higher concentrations nearer said surface of said substrate relative to portions of said first region deeper within said substrate.” For this reason, Kawakami et al. does not anticipate.

Also, Kawakami et al. fails to disclose “a third region of said substrate, said third region having a dopant concentration substantially the same as said substrate dopant concentration and separating said first and second regions from each other.”

The Office Action indicates that Kawakami et al.'s regions 105 and 305 are sufficient to disclose the third region recited by the claim; this is incorrect. Neither region 105 or 305 of Kawakami et al. has "a dopant concentration substantially the same as said substrate dopant concentration." Further, neither region 105 or 305 of Kawakami et al. "separate[s] said first and second regions from each other." There is nothing separating the referenced Kawakami et al. first (304) and second (333) regions from one another.

For each of the above reasons, claim 235 is not anticipated by Kawakami et al. The rejection of this claim is respectfully requested to be withdrawn.

Claims 30-35 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 5,962,882 ("Sin"). Applicant respectfully traverses this rejection.

Independent claim 30, as amended, has been set forth above in relation to the discussion of its patentability over the Patrick reference. Sin does not anticipate the claim.

For the same reasons already set forth above regarding claim 30's patentability over Patrick and Kawakami et al., it is likewise patentable over Sin. Sin does not disclose "a second region of said substrate, said second region being adjacent to said first region, said second region having a dopant concentration substantially the same as said substrate dopant concentration." Regions 78 and 76 of Sin, cited in the Office Action as being disclosures of such a second region, clearly do not have "a dopant concentration substantially the same as said substrate dopant concentration." Region 76 is doped like region 82 (to a lesser degree), giving it a photodiode implant.

Also, Sin fails to disclose "a third region of said substrate, said third region being doped to a second conductivity type, located substantially beneath said first

region with respect to said substrate surface, separated from said first region by said second region, and being configured to collect photogenerated charge," since region 74 (cited in the Office Action as being a disclosure of the recited third region) is clearly not "separated from said first region (84 in the Office Action) by said second region (78/76 in the Office Action).

For each of the above reasons, independent claim 30 and dependent claims 31-35 are not anticipated by Sin. The rejection of these claims is respectfully requested to be withdrawn.

Claims 30, 33, and 34 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent Application Publication 2002/0048837 ("Burke") or by U.S. Patent 5,430,312 ("Effelsberg") or by U.S. Patent 6,287,886 ("Pan"). Applicant respectfully traverses this rejection with regard to each reference.

Independent claim 30, as amended, has been set forth above in relation to the discussion of its patentability over the Patrick reference. Burke, Effelsberg, and Pan do not anticipate the claim.

Burke, for all the same reasons set forth above for the patentability of claim 30 over the Patrick, Kawakami et al., and Sin references, fails to anticipate the claim. Burke does not disclose any region separating what the Office Action calls the first (36 or 36/38) and third region (48). Therefore, Burk fails to disclose, at least, "a third region of said substrate, said third region being doped to a second conductivity type, located substantially beneath said first region with respect to said substrate surface, separated from said first region by said second region, and being configured to collect photogenerated charge," as recited by claim 30. For this reason, independent claim 30

and dependent claims 33 and 34 are patentable over Burke and the rejection is respectfully requested to be withdrawn.

Effelsberg, like Burke, fails to disclose "a third region of said substrate, said third region being doped to a second conductivity type, located substantially beneath said first region with respect to said substrate surface, separated from said first region by said second region, and being configured to collect photogenerated charge," as recited by claim 30. Further, region "18b" of Effelsberg is not part of the substrate, it is a FOX region and therefore not "a second region of said substrate" as recited by claim 30. For these reasons, independent claim 30 and dependent claims 33 and 34 are patentable over Effelsberg and the rejection is respectfully requested to be withdrawn.

Pan, like Effelsberg, fails to disclose "a third region of said substrate, said third region being doped to a second conductivity type, located substantially beneath said first region with respect to said substrate surface, separated from said first region by said second region, and being configured to collect photogenerated charge," as recited by claim 30. Further, region "44" of Pan is not part of the substrate, it is a FOX region (like region 18b of Effelsberg) and therefore not "a second region of said substrate" as recited by claim 30. For these reasons, independent claim 30 and dependent claims 33 and 34 are patentable over Pan and the rejection is respectfully requested to be withdrawn.

Claims 30-35 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent 6,417,023 ("Suzuki et al."). Applicant respectfully traverses this rejection.

Independent claim 30, as amended, has been set forth above in relation to the discussion of its patentability over the Patrick reference. Suzuki et al. does not anticipate the claim.

Suzuki et al., like Effelsberg and Pan, fails to disclose "a third region of said substrate, said third region being doped to a second conductivity type, located substantially beneath said first region with respect to said substrate surface, separated from said first region by said second region, and being configured to collect photogenerated charge," as recited by claim 30. Further, region "34" of Suzuki et al. is not part of the substrate, it is a FOX region (like region 18b of Effelsberg and 44 of Pan) and therefore not "a second region of said substrate" as recited by claim 30. For these reasons, independent claim 30 and dependent claims 32-35 are patentable over Suzuki et al. and the rejection is respectfully requested to be withdrawn.

Claims 7-11, 13-16, 23, 26, 27, 35-39, 44, 47, and 48 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kawakami et al. Applicant respectfully traverses this rejection.

Independent claim 1, from which claims 7-11, 13-16, 23, 26, and 27 depend, as amended defines a photoconversion device and recites "a substrate having a surface" and "a doped region in said substrate and at said surface thereof, said doped region being of a first conductivity type and having a graded profile, wherein said doped region has a higher dopant concentration near the surface of the substrate" and "a charge accumulation region in said substrate and substantially below said doped region, said charge accumulation region being of a second conductivity type." This is not taught or suggested by Kawakami et al.

Kawakami et al. fails to teach or suggest a "doped region being of a first conductivity type and having a graded profile, wherein said doped region has a higher dopant concentration near the surface of the substrate," as recited by claim 1. For this reason, Kawakami et al. would not have rendered the subject matter of independent

claim 1, or any dependent claim, obvious. Applicant respectfully requests that the 35 U.S.C. § 103(a) rejection of claims 7-11, 13-16, 23, 26, and 27 be withdrawn.

Independent claim 30, from which claims 35-39, 44, 47, and 48 depend, has been discussed above and shown to be patentable over Kawakami et al. For the same reasons that independent claim 30 is patentable over Kawakami et al., so is each dependent claim. This rejection is respectfully requested to be withdrawn.

In view of the above amendment, applicant believes the pending application is in condition for allowance.

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Respectfully submitted,

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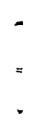
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Attachments

Appendix A: replacement drawings
mark up drawings



MARK-UP

MARK-UP



MARK-UP

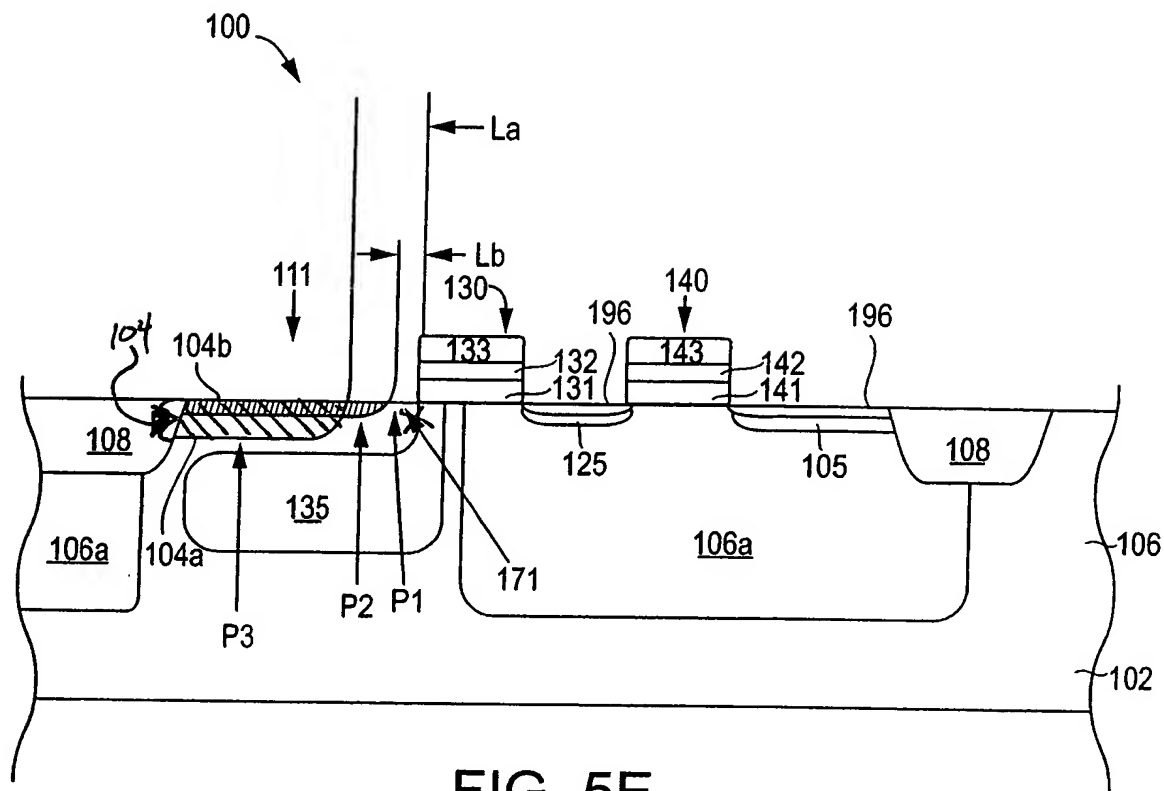


FIG. 5E

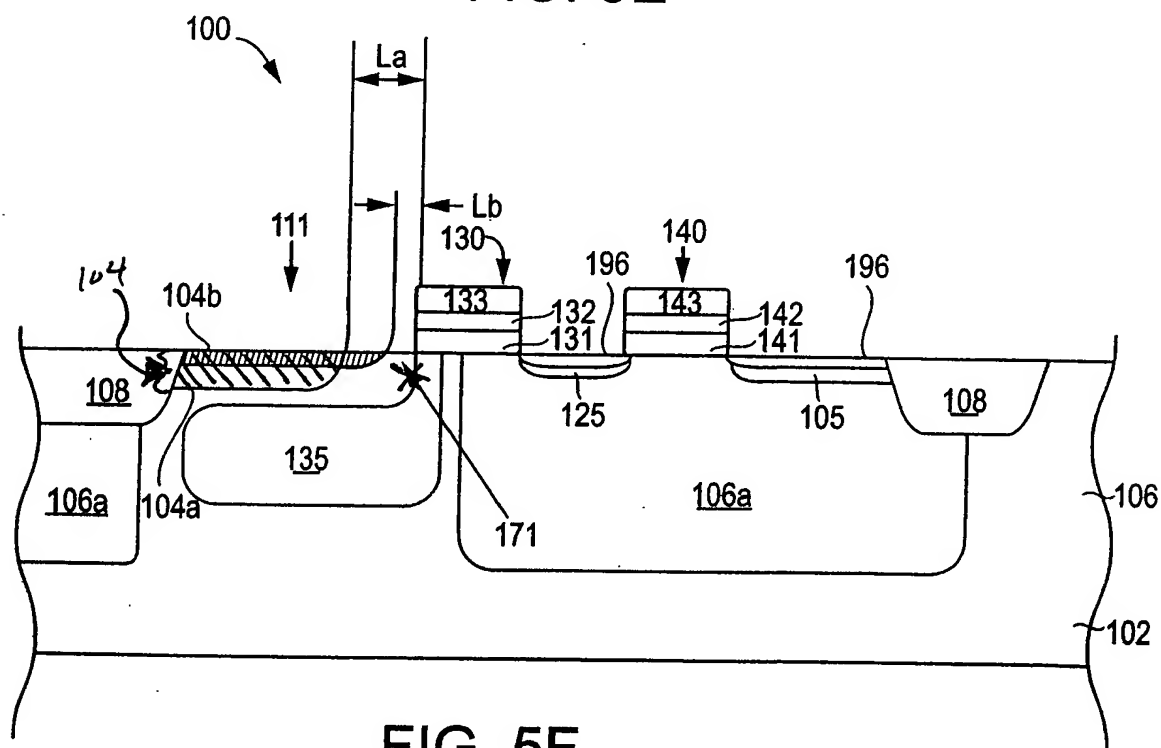


FIG. 5F

MARK-UP

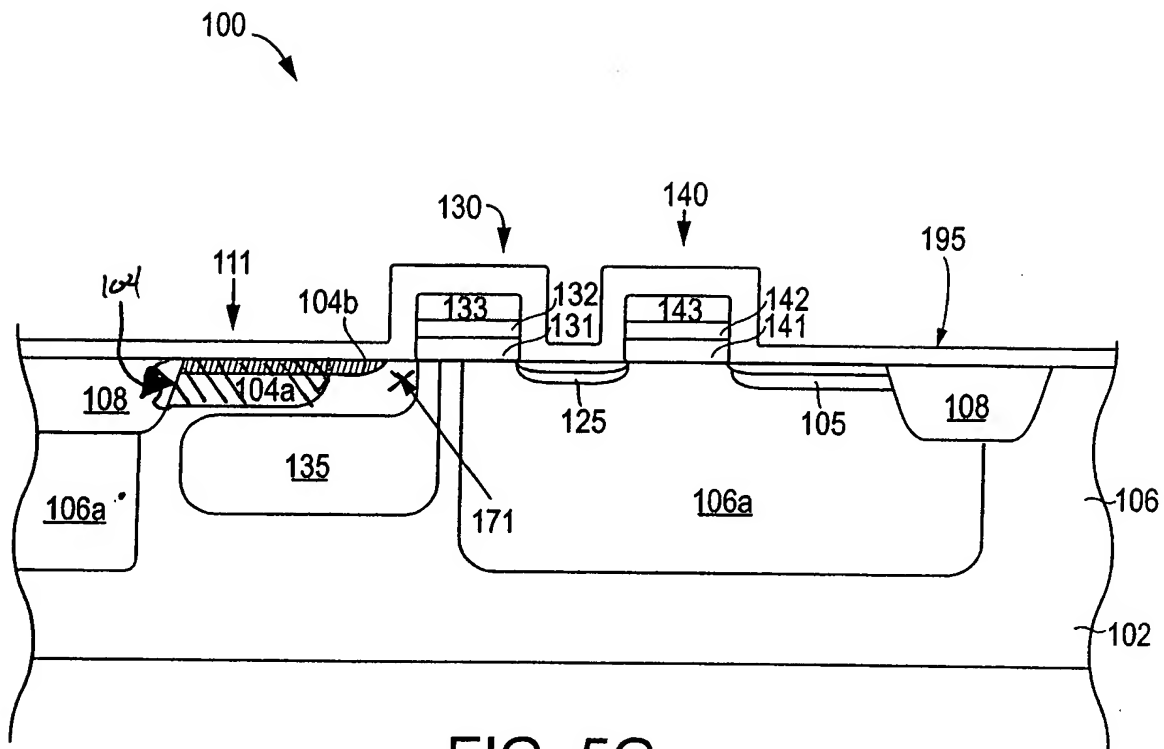


FIG. 5G

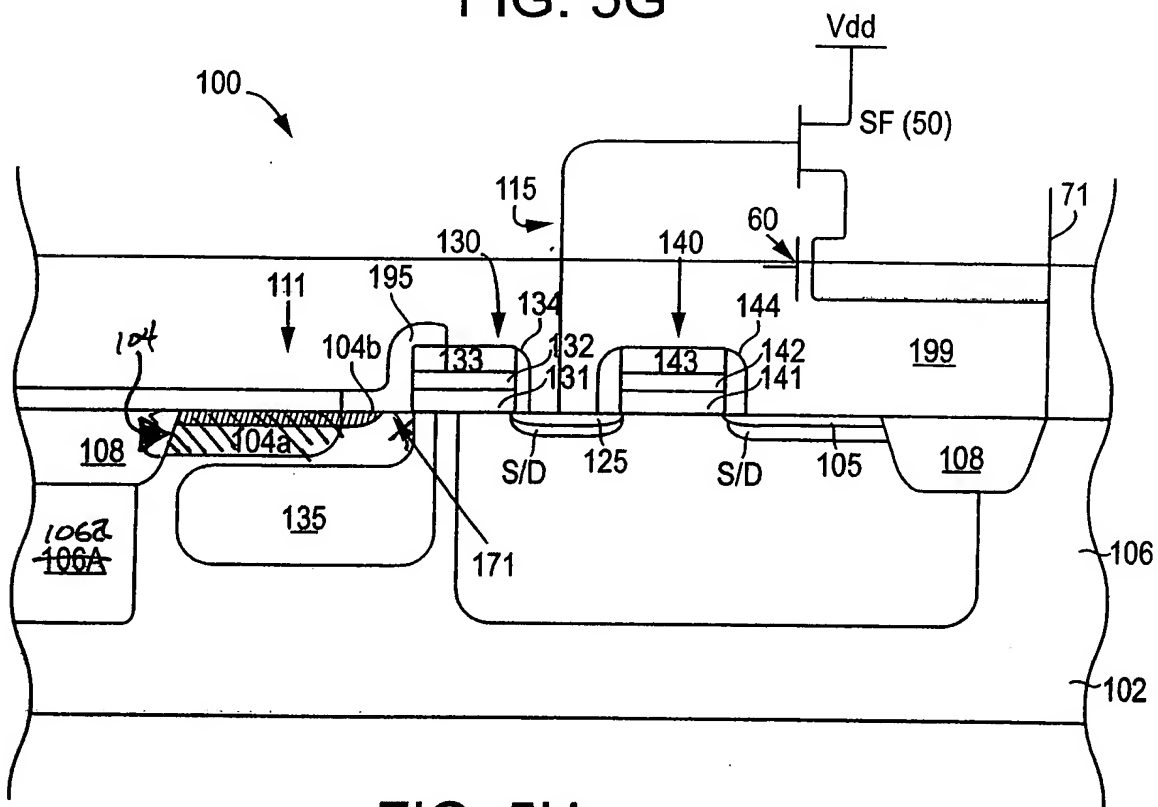


FIG. 5H

MARK-UP



MARK-UP

11/18

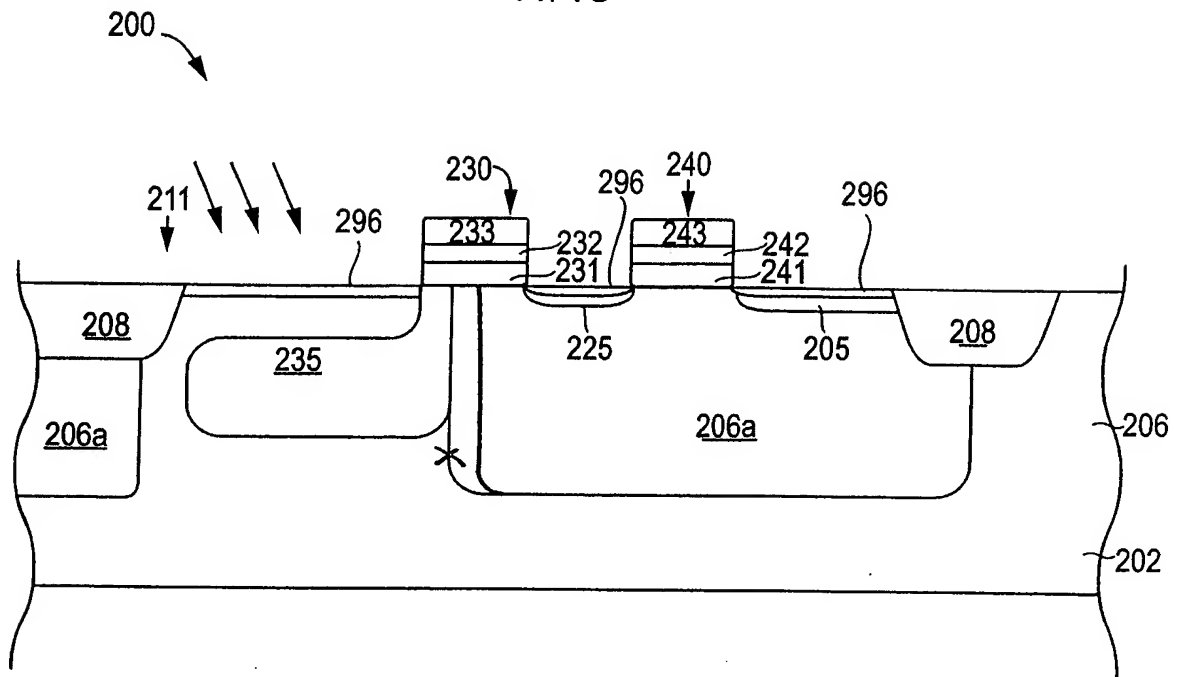


FIG. 7E

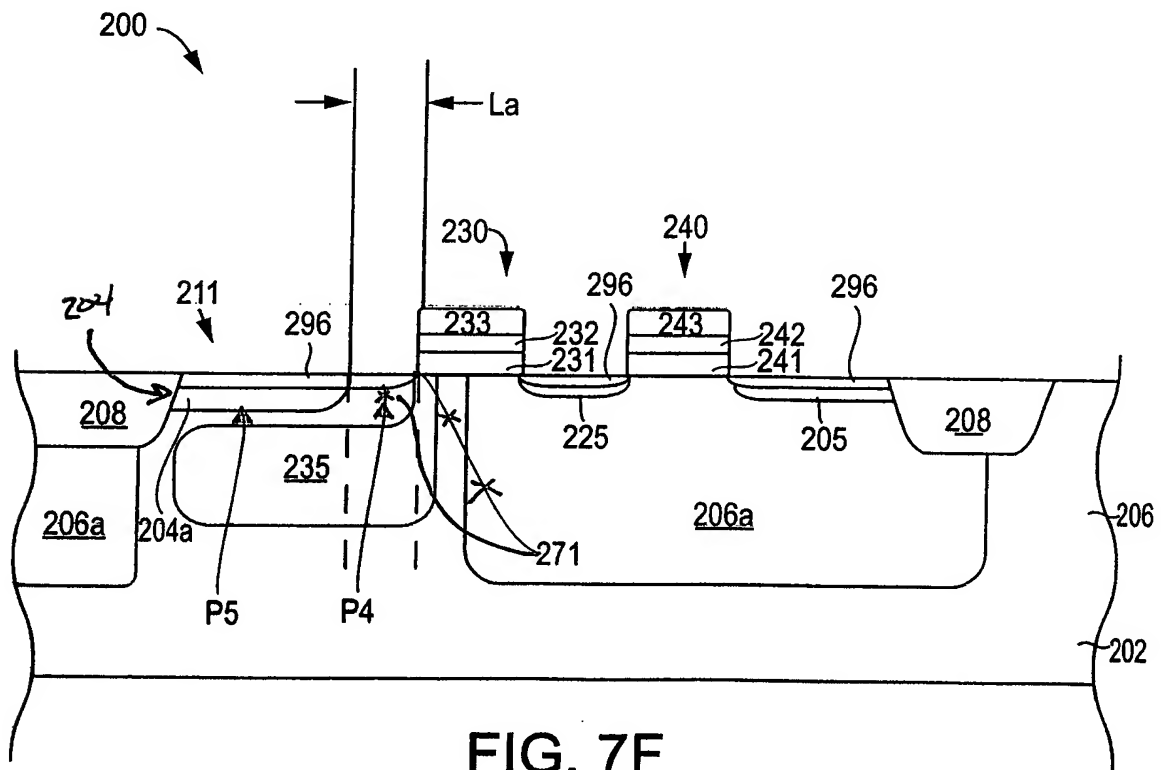
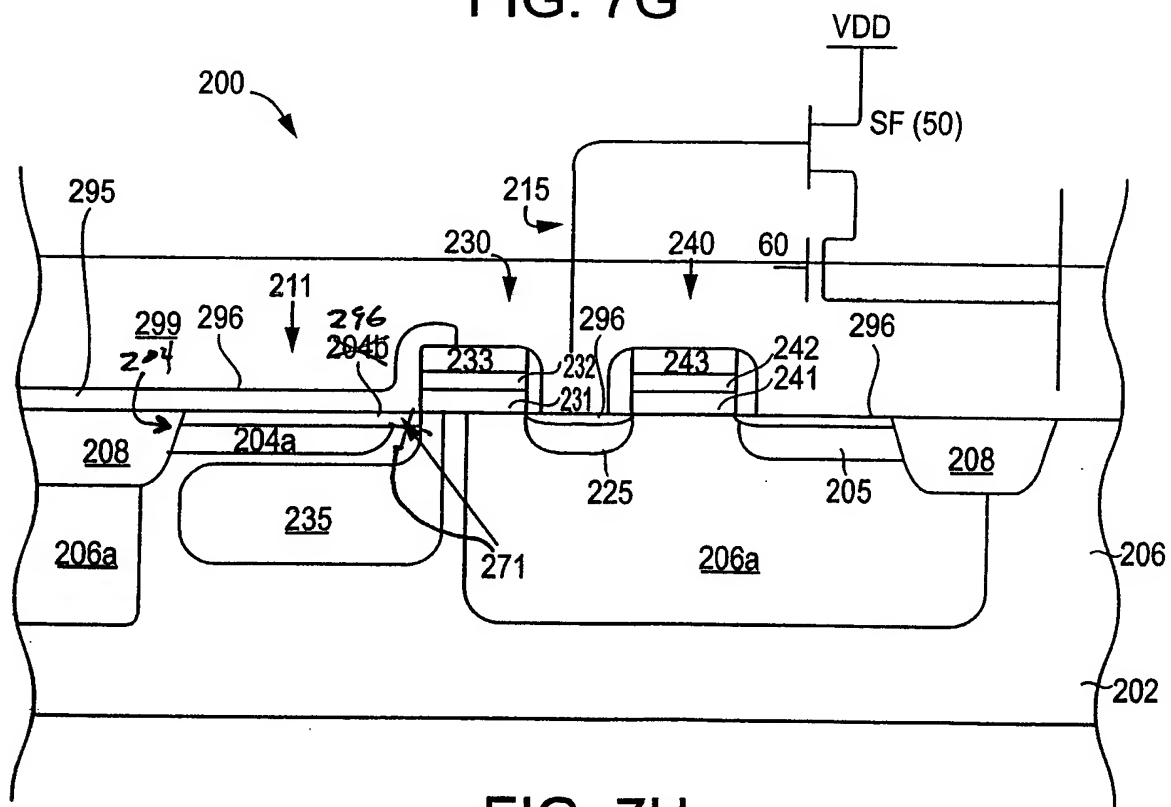


FIG. 7F

MARK-UP



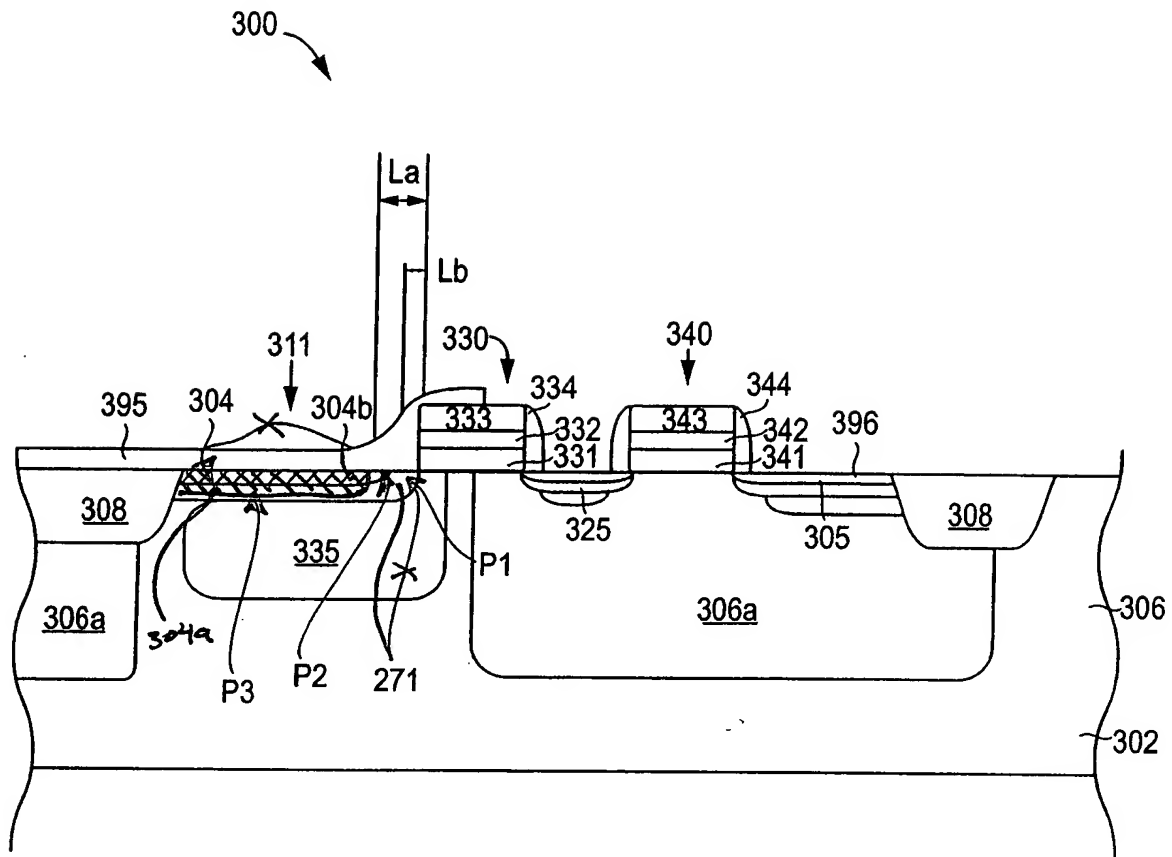


FIG. 8

MARK-UP

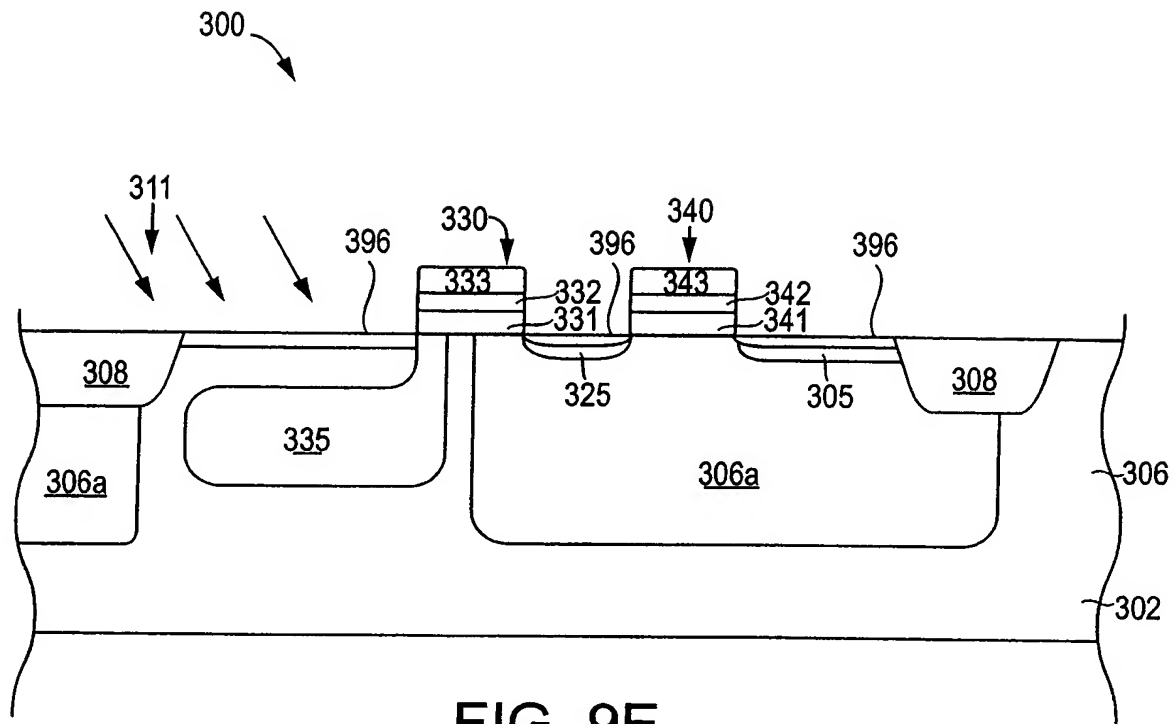


FIG. 9E

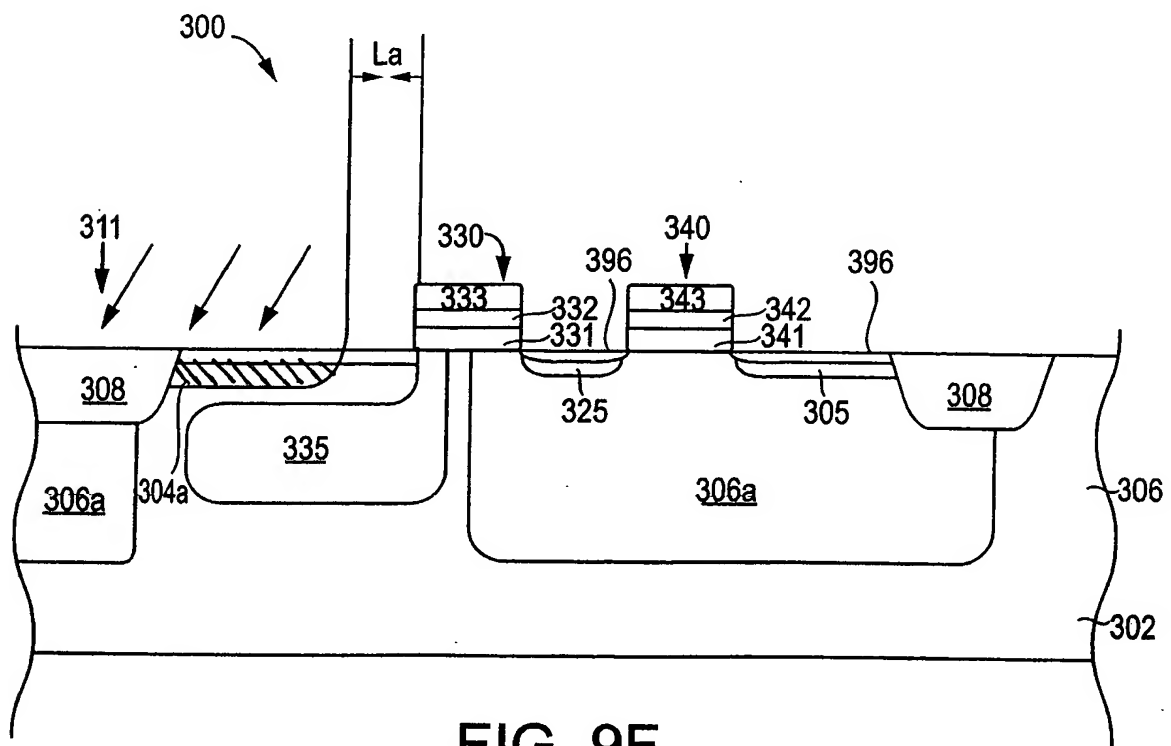


FIG. 9F

MARK-UP



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